

Green nudging*

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Abstract: Our current lifestyle is not sustainable. One way to increase sustainability is by developing greener technologies. Another, complementary way, is by altering people's attitudes, habits, and behaviors. Here we discuss six techniques that aim to gently push or *nudge* people towards more pro-environmental choices and behaviors. These techniques range from ones that can be applied from a distance, e.g., techniques which could inform the construction of communication messages, to ones that involve changes in the context where the choice takes place. Therefore, the present review can be of interest to practitioners such as marketers, policymakers, and consumer representatives. For each technique, we discuss its theorized cognitive and/or emotional underpinnings. Furthermore, we identify gaps in the literature and ways in which future research could fill these gaps.

Key words decision-making; nudging; pro-environmental decisions; context effects

Public Policy and Behavioral Decision Research

In modern societies the resolution of public problems, which are often complex, frequently relies on the active involvement of citizens. Citizen involvement can take many forms. In developed countries, for example, a number of public goods are supplied privately. Philanthropic organizations, churches and other religious associations, labor unions, political parties, health research campaigns, private radio and television channels, all depend on a substantial way on voluntary monetary contributions (see Oppenheimer & Olivola, 2010, for a review of experimental studies on charity giving).

Apart from monetary contributions, citizens can help resolve public problems more actively by dedicating part of their free time to carrying out volunteer work. In Italy, for instance, the Italian institute of socioeconomic studies (CENSIS) estimates that approximately one-eighth of Italian citizens devote more than one-third of their free time doing

volunteer work for a non-profit organization. Yet another form of citizen involvement is through political activism. For example, citizens could sign a petition or cast a vote in a referendum regarding a specific initiative. Finally, citizens can also aid in the resolution of public problems by changing their attitudes, lifestyles, behaviors and habits. Consider, for example, the small habitual actions citizens can perform to combat the diffusion of the Asian tiger mosquito, to recycle waste, or to combat environmental pollution.

This last form of citizen involvement, changing citizens' behavior, can provide one of the most effective means of promoting a public good when viewed from a cost-benefit standpoint. Here we will discuss of a specific approach—*nudging*—that offers a promising alternative way to public policy-making based on economic incentives that aim to either punish unwanted behavior (by putting in place administrative sanctions, such as fines, taxes, and

Received Date: 2017-04-17

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other suppressive mechanisms) or promote desirable behaviors (e.g. by providing contributions towards the acquisition of more efficient house appliances such as washing machines). Indeed, *nudging* is one of the most popular approaches aiming to alter citizens' behaviors (for discussions see Bhargava & Loewenstein, 2015; Halpern, 2015; Sunstein, 2014). Its intellectual origins can be traced to Thaler and Sunstein (2003) and Camerer et al., 2003. *To nudge* someone can be translated as to prod someone into action, to push gently, especially with the elbow.

The main advantage of *nudging* over other techniques is that it alters behavior by acting on the intuitive system of the decision-maker; it is not based on suppressive mechanisms or on the promotion of an analytic/reflective mode of thinking (for an introduction to dual-system approaches of judgment and decision-making, see Kahneman, 2011). Furthermore, its application frequently requires minimal costs for the public administration. As Thaler and Sunstein (2008) note: nudging refers to "any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives" (p. 6). In the words of the Nobel Laureate Daniel Kahneman, nudging yields "medium-sized gains by nano-sized investments" (see Bhargava & Loewenstein, 2015, p. 397).

In the present review we discuss six nudges that aim to promote pro-environmental choices and behaviors. We do not present an exhaustive list, and do not offer a new theoretical foundation for the nudging approach. Rather, our aim is to discuss nudges that cover the entire decision process: from the initial intelligence gathering to the actual choice. For example, we discuss nudges that concern the design of a distant communication where the citizen is first informed about the public good/action (e.g. information about the opportunity cost of a green action) but also nudges that pertain to the design of the actual choice context where the citizen is asked to make a decision (e.g. ambient smell and choice menu display). Each nudge relates to a specific psychological mechanism, which we fully describe and

comment. We review papers that, in our judgment, outline the most effective psychological mechanisms to induce pro-environmental decisions. By providing examples of nudges that cover many aspects of the decision process, the present review can be of relevance to practitioners such as marketers, policymakers and consumer representatives.

Referent points and evoked sets

The first nudge we will discuss can be utilized to construct effective communication strategies, such as when informing citizens about the costs and benefits of a particular behavior. Its efficacy is based on the fact that people, when they are asked to evaluate a target public good, are influenced by comparison standards (points of reference), which can be altered, either explicitly or implicitly, through a communication message (the importance of reference points has been highlighted in *prospect theory*, Kahneman & Tversky, 1979).

For example, one way of altering the comparison standards when evaluating a certain public good involves explicitly stating alternative uses of money or, more technically, stating the opportunity costs. For example, we can ask a person to contribute money to an intervention (reforestation) related to a public good (e.g. a certain park). At the same time, in the message we could indicate alternative uses of the suggested monetary contribution for the public good. That is, we could state that instead of donating the money to support the target public good one could use it to buy an alternative product.

Consider, for example, the work of Bonini, Biel, Gärling and Karlsson (2002, Study 1). A sample of Swedish citizens were asked to state their willingness to pay (WTP) to combat the acidification of Swedish lakes. In one condition (low opportunity cost), the participants were informed that instead of contributing for the public good they could spend the money (200 SEK [Swedish Krona]) to purchase an annual pass for the museum of the Goteborg Bank. In another condition (high opportunity cost), participants were instead informed that they could use the money to buy a concert ticket. The results show that in the high opportunity cost condition (concert ticket), the

participants' mean contribution towards the public good was 131 SEK, while in the low opportunity cost condition (museum pass) the mean contribution was significantly higher, 180 SEK. Evidently, the specific example used to highlight an alternative use of money — which is arbitrary — proved to be psychologically relevant as it influenced the contribution towards the target public good. The message of this research is clear: to promote monetary contributions towards pro-environmental causes the communication message could compare the requested contribution for the public good to a contribution for something that the participants perceive to be of lesser value.

Standards of comparison can be evoked in many different ways. Apart from mentioning examples that emphasize the opportunity cost of a contribution, one could instead ask a person to recollect a positive or negative consumer experience. In this way, one could evoke either a positive or negative comparison standard. The role of episodic memory on people's WTP for a public good was studied by Bonini et al. (2002, Study 2). The results showed that Swedish citizens were more WTP to clean up their country's lakes when they had been previously asked to recall a negative consumer experience versus a positive consumer experience. Specifically, in the negative memory prime condition, participants were willing to contribute on average 185 SEK towards the public good, whereas in the positive memory prime condition, the average contribution dropped to 140 SEK.

A third way of altering the comparison standards against which people are likely to compare the target public good is by presenting, together with the public good, one or more other public goods. In so doing, an individual is forced to consider the target public good in the context of the other public goods (which are not necessarily competing). The specific public goods that are presented simultaneously with the target public good, as we will see below, can sway people's willingness to contribute toward it.

In the pioneering studies of Daniel Kahneman and his collaborators (Kahneman & Ritov, 1994;

Kahneman, Ritov, & Schkade, 1999; Ritov & Kahneman, 1997) it was demonstrated that individuals' evaluations of a public good are influenced by the evaluation context, and in particular by whether the public good is evaluated in isolation versus jointly with other public goods. For example, when a good concerning the protection of dolphins and another good concerning prevention of skin cancer for farmers were evaluated separately (separate evaluation), overall participants were relatively more WTP to save the dolphins than to protect farmers from skin cancer. However, when the two goods were evaluated simultaneously (joint evaluation), overall participants were more WTP for the farmer than the dolphin problem—revealing the exact opposite preference than that suggested by the separate evaluations.

One interpretation of these findings is that the separate evaluation and the joint evaluation modes prompt different thinking processes. Specifically, when a public good is evaluated in isolation, people's WTP may principally depend on the immediate affective reaction (integral affect) that the public good triggers (e.g., "I love dolphins"). However, when a public good is evaluated jointly with another, its evaluation is likely to also depend on other factors such as the pros and cons of contributing to this good versus to the other good that is mentioned (e.g., "it is not reasonable or ethical to pay more money to protect animals than to protect people").

These findings, and the associated theoretical accounts, carry practical implications for the design of public policy. For example, if one wishes to make citizens more likely to evaluate a public good affectively (this would be desirable, for instance, when a public good typically prompts a strong affective response), then it is preferable to avoid comparisons with other public goods, irrespective of whether these other goods are perceived to be comparatively lower or higher in importance. However, when the target public good is unlikely to trigger a strong emotional response, it might be better to present it together with other public goods that the majority of people consider to be of lesser importance.

However, there exists an alternative interpretation

of these findings. According to this interpretation, the differences between separate and joint evaluations arise because the comparison goods in the two evaluation contexts differ. When a single public good is presented, people *spontaneously* compare it to other public goods that belong to the *same category* (*natural evoked set*). For instance, in the separate evaluation condition, citizens might compare the value of saving dolphins against the value of saving other endangered animal species, while they might compare the value of preventing skin cancer against the value of preventing other forms of cancer. Because dolphins are perceived to be relatively important in comparison to other endangered animals, while skin cancer is perceived to be relatively unimportant in comparison to other, more lethal, forms of cancer, the WTP for dolphins is higher than the WTP for farmers when these goods are evaluated separately. However, this natural comparative process is “blocked” in the joint evaluation condition in which both public goods are presented together. Here, the participants are forced to compare the two public goods, which they would not normally do in the separate evaluation condition, and this can alter their choices. For example, their choice may be influenced by a consideration of reasons to contribute for one good rather than for the other (see *reason-based choice* by Shafir, Simonson, & Tversky, 1993)

Experimental results in support of this hypothesis have been obtained by Bonini, Ritov and Graffeo (2008). Bonini and colleagues (2008) reasoned that if people spontaneously compare a public good to other goods from the same category (spontaneously evoked set), then evaluating a target good jointly with either a low-importance or high-importance public good from *the same category* should leave judgments for the target good unaffected. However, evaluating a target good jointly with either a low-importance or high-importance public good from *a different category* should increase judgments for the target good in the former instance while decrease them in the latter. In support of their predictions, Bonini and colleagues found that 38% of the participating Israeli interviewees were willing to financially support

target problems, such as “conservation of early twentieth-century buildings in Hanevi’m Street in Jerusalem” and “expanding the activities of the scout movement,” in the context of relatively low-importance referent problems from the *same category*, while 34% in the context of relatively high-importance referent problems from the *same category*. However, when the referent problems belonged to a *different category*, the percentage increased to 40% when the referent problems were relatively low-importance, and dropped drastically to 19% when they were relatively high-importance. The same pattern of findings was found when people were asked instead about whether they would sign a local petition, that is, whether they would support a public action politically.

The results presented in this section carry implications for the construction of communication strategies. All else being equal, to achieve a high contribution for a target public good, one should present it jointly with less important goods from a different category. Future studies could investigate whether presenting information about opportunity costs, alternative public goods, or both, is more effective in increasing people’s willingness to support a target public good through monetary or other means.

The communication of a social norm

The second nudge that we will discuss—the communication of a social norm—can also assist in developing effective communication strategies. This strategy involves informing citizens about what the majority of other people do in a certain situation (e.g., “most people are willing to give a small contribution to help reforestation”; “nine out of ten clients which stayed in this hotel room reused their towel”). Social psychologists refer to such messages as messages stating a *social norm*. Cialdini and Trost (1998) define social norms as the rules that are accepted by a group, and which have the capacity to guide and constrain people’s behavior. Just as the violation of law is punished, the violation of social norms is also punished. However, the type of punishment differs. Social norm violation is not punished by the law authorities but rather by one’s peers. The sanctions

usually involve various forms of ostracism, that is, the marginalization of a person from a group. It is noteworthy to mention that social norms can be used (either consciously or unconsciously) to promote many types of behaviors ranging from peaceful social interactions, law-abiding behaviors, to illegal actions (if most people do not pay taxes, then a person may be enticed not to pay taxes). Thus, the communication of social norms can cut both ways—it can promote both desirable and undesirable behaviors, and thus it should be used with caution.

Cialdini and Trost (1998) sustain that the reason why social norms exist is because humans, through them, aim to achieve various objectives. Some norms aim to increase the efficacy of certain actions especially in contexts surrounded by ambiguous circumstances. In such contexts, people often observe others and consider their behaviors as a valuable source of information. Norms concerning what other people do are known as *descriptive social norms*. The impact of a descriptive social norm increases the more people follow that norm, because norm following is interpreted as evidence that the norm is adequate. Furthermore, it is more probable that a social norm will be followed if we perceive norm followers as similar to us rather than different—if a norm is adequate for such and such people that are similar to us, then it should also be adequate for us.

Cialdini, Reno and Kallgren (1990) examined how descriptive social norms influence behaviors through experimental studies. These authors conducted experiments in various locations (e.g., playgrounds, parking lots, etc.). On alternate occasions they manipulated whether the location was clean or dirty. Their idea was that when people find themselves in a clean environment they may infer that the social norm is to keep the environment clean, given that other persons that have been in that environment did not litter. But when people find themselves in a dirty environment, they may infer that the social norm is to litter, given that other people have done so (see also the “broken windows” theory, Wilson & Kelling, 1982; and Zimbardo, 1969). In one experiment, the participants (who were not aware that they were

observed) found some advertisement flyers in their cars. These flyers were of the type that most people would throw away in the earliest occasion. The results show that participants behave in a way congruent to that indicated by the social descriptive norm: participants were more likely to throw the flyer on the ground when the environment (parking lot) was already littered, than when it was clean.

Another human need is the need to acquire resources and social support in order to improve one’s quality of life. A particularly effective strategy to satisfy this need is the creation of social networks. One way in which people may seek other group members’ approval is by following the norms of the group. Cialdini and Trost (1998) called norms concerning what the majority of people believe that one *should* or *should not* do as *injunctive social norms*. Injunctive norm compliance is motivated by prizes and punishments that other people are ready to issue in response to our actions.

For example, if one finds a wallet on the ground a common injunctive norm in many cultures/social groups is to return it to its lawful owner. This is the socially responsible thing to do, that is, the behavior which would gain approval by the group. In a fascinating study, Hornstein, Fisch and Holmes (1968) left wallets in the streets of New York, containing money, documents, and a note. The note appeared to be written by a passerby who found the wallet and left it in a prominent place so that its lawful owner could find it. In certain cases the note appeared to be written by a US citizen (an in-group member for most of the participants), whereas in other cases by a person that had recently immigrated to the US (an outgroup member for most of the participants). The proportion of people that made an effort to return the wallet was twice as high in the first case than in the second case. The authors interpreted this result as showing that injunctive norms, which normally have a general nature, vary in force depending on the similarity between the person that makes them explicit (e.g. the author of the note) and the person that must enforce them (e.g. the participant). The more similar these persons are, the more likely that

the injunctive norm would be approved and respected. However, if these persons are dissimilar, as in the case of the immigrant who is perceived to be different and distant, the injunctive norm is perceived to be less important and is more often ignored.

The use of a communication strategy based on social norms (descriptive or both descriptive and injunctive) to support a pro-environmental cause has been studied by Schultz et al. (2007). In the San Marcos community in California they performed a field experiment. Households in this community received normative feedback pertaining to how much energy they consumed in previous weeks along with information of how much, on average, other households in their neighborhood have consumed. The experimenters divided households into ones with above average consumption and ones with below average consumption. Half of the households in each condition received only descriptive feedback (e.g., that they have consumed either above or below average), while the other half the descriptive feedback was supplemented by an appropriately valenced emoticon (either ☹ or ☺). The main dependent measure was how much energy the households consumed in subsequent periods.

The results showed that when participants received only descriptive feedback, the energy consumption in subsequent periods tended to move toward the norm. That is, households with above average energy consumption tended to consume relatively less than previously, and those with below average energy consumption tended to consume more than previously. Thus, in the latter case the normative feedback induced what is known as a *boomerang effect*. Importantly, the results showed that when the descriptive feedback was supplemented with an appropriately valenced emoticon, households with above average energy consumption tended to consume less, but critically households with below average consumption continued to consume less. Otherwise stated, the inclusion of the emoticon eliminated the *boomerang effect*. The message for policy makers is clear: for a message to be effective together with a descriptive norm it should also communicate clearly

the behavior that is deemed acceptable by a social group (e.g., by means of an appropriately valenced emoticon).

Studies have also shown that people's behavior is not only influenced by descriptive and injunctive norms, but also by the specific manner in which the norms are communicated. For example, a social norm can be communicated in a generic/abstract way or in a more vivid way. More specifically, the communication may involve a dry statistic ("nine out of ten clients reuse their towel"; "your electricity consumption exceeds the mean consumption of your neighbors by 10%"), but could also be supplemented by vivid details about the citizens mentioned in the norm (e.g., by providing a detailed description of them).

Recently, Graffeo, Ritov, Bonini and Hadjichristidis (2015) examined whether a communication of a descriptive norm (e.g., your electricity consumption exceeds by 10% that of comparable others) is more effective when supplemented by information specifying who these "comparable others" are. The authors varied who the "comparable others" are following a 2×2 design. The first factor concerned whether the comparative others lived in the same neighborhood as the participants or in a different neighborhood, while the second whether or not additional details about their comparative others (their names and a photograph) were provided. The authors also included two control conditions: one in which no feedback was provided, and another where only statistical feedback was provided (feedback about the average household in their home country). The results showed that the condition associated with the highest willingness to reduce their electricity consumption was the one where the comparable others came from the same neighborhood as the participants but their members were not identified. (Perhaps giving further details about the comparable others increases the perceived dissimilarity between oneself and those others). Therefore, the results of this study suggest ways to further tweak how descriptive norms are presented to help promote even "greener" behaviors.

The use of a foreign language

The third nudge that we will discuss concerns the

language in which a message is communicated and, specifically, whether this is a person's mother tongue or a foreign language (i.e., a language that the person knows well but mostly through formal instruction or education). Recent studies have shown that communicating information in a foreign versus a native language can impact moral judgments (see Costa et al., 2014; Geipel, Hadjichristidis, & Surian, 2015a, 2015b, 2016) and judgments of risk and benefit (see Hadjichristidis, Geipel, & Savadori, 2015). More pertinently to the present purposes, research has also shown that foreign language use can also influence consumers' response to advertising messages (Puntoni, de Langhe, & van Osselaer, 2009). The main explanation is that the use of a foreign language reduces emotionality and thus leads to judgments that are less swayed by affective considerations (see Caldwell-Harris, 2015; Hadjichristidis, Geipel, & Surian, 2017; Keysar, Hayakawa, & An, 2012; Puntoni et al., 2009; for recent reviews see Hayakawa, Costa, Foucart, & Keysar, 2016, and Costa, Vives, & Corey, 2017).

Of particular interest to the present purposes is a study by Geipel, Hadjichristidis and Klesse (2018), which, extending on the work of Puntoni et al. (2009), investigated whether the use of a foreign language promotes higher intentions to consume certain sustainable products that people typically find just too disgusting to consume (see Rozin, Haddad, Nemeroff, & Slovic, 2015). Specifically, Geipel and colleagues investigated people's willingness to consume recycled water, artificial meat, and insect-based food. In all three cases, the use of a foreign language promoted higher willingness to consume. Importantly, in a further study, the authors found that the use of a foreign language influenced consumers' willingness to consume through attenuating feelings of disgust.

Finally, these authors found that the use of foreign language can also sway behavior. In one of their studies, participants after being presented with a brief description of recycled water (either in a foreign or native language), were provided with a glass of "recycled water" from which they could drink as

much or as little as they wished. The authors then measured how much "recycled water" each participant consumed. For participants who stated that they were thirsty at the beginning of the experiment, there was no effect of language. However, for participants that reported that they were not thirsty, foreign language promoted higher recycled water consumption.

Given that we live in increasingly multicultural and multilingual societies, in which people are accustomed to receive communications in what is for them a foreign language (e.g., English), the suggestions relating to these findings are actionable (Teachman, Norton, & Spellman, 2015). Foreign language nudges should be particularly effective in promoting target public goods that typically prompt an aversive affective reaction, such as recycled water or insect-based food. However, it is noteworthy to mention that in certain cases foreign language communications—just as messages stating descriptive norms—may backfire. Consider, for example, affective advertisement that aims to deter undesirable behaviors such as the messages "Smoking kills" or "Smoking causes impotence" in cigarette packs. The use of a foreign language may reduce the impact of such messages (see Puntoni et al., 2009). Thus, foreign language use should be employed strategically.

The "default" option

A default option refers to the preselected option. It is the option that would be automatically followed unless a decision maker actively opposes it (e.g., by ticking "I do not wish that my information is passed to third parties" in an internet site). Default choices are taken on the basis of presumed or implied consent, rather than on the basis of explicit consent. Default choices are commonly used in legal contracts, technological environments, and other consumer environments. In technological environments, for example, several operating systems, software packages, and technological instruments have preselected defaults from the programmer/ constructor. For example, Windows 10 has Microsoft Edge as the default internet provider, and Bing as the default browser. Similarly, in the context of online acquisitions, certain main consumer goods (e.g., a train ticket, a

personal loan) were by default bundled together with accessory goods (e.g., seat booking, an insurance policy). Although the client is allowed to change the default option (the client can opt-out from the seat booking or the insurance policy), few do so. Also for this reason, such commercial practices have been banned from the EU.

The manipulation of the default choice is one of the most potent and frequently used nudges. It operates on the design of the choice architecture and, in particular, on how the alternatives are structured/organized. There exist various accounts as to why people tend to “select” a default option. First, people may not even notice that they had to make a choice. Second, people may notice this but assume that the default option is recommended by a competent authority (e.g., by the state). Third, actively making a decision involves costs in terms of money and time; going along with the default avoids such costs. Finally, it has been demonstrated that people prefer not to choose (*omission bias*), accepting the consequences of this inertia, rather than assuming the responsibility to act (Ritov & Baron, 1992). The presumed source of the omission bias is that people judge more negatively undesirable outcomes that result from action (for which they are responsible) than ones that are the consequence of inaction. Thus, people may prefer to go along with the default to avoid the psychological cost associated with coming to terms with a (bad) action.

The manipulation of the default choice has been studied in very diverse domains ranging from organ donation to the contribution toward pensions (see Thaler & Sunstein, 2008). More pertinent to the present purposes, this strategy has also proven effective in promoting environmental goods and, in particular, “green” electric tariffs which involve electricity deriving from renewable sources (for *green defaults*, see Pichert & Katsikopoulos, 2008)

To get a glimpse of what it means to design the choice environment and how effective and easy it is to implement a default choice strategy, consider the change of the *default* settings on the printers in Rutgers University. Rutgers University changed the

default setting from “single-sided” printing (persons who wanted “double-sided” printing could simply select that option) to “double-sided” printing (naturally, whomever wanted “single-sided” printing could simply change the default option). The results from the first semester after the change was implemented showed a saving of 7 million pages, or about 620 trees (Rutgers, 2017). An example of a dual strategy—default choice selection *and* economic incentive—concerns some policies about how to send clients invoices and receipts. In the USA, several banks, energy suppliers, and telephone companies, by default send bills in electronic format. Clients may request a hard copy of the bill but they have to *specifically ask* for this service and *are charged* for it [see *La Note d’Analyse*, Premiere Ministre, Republique Francaise, March 2011, n. 216, p. 4].

The setting of the default option is a good example of “libertarian paternalism” (see Thaler & Sunstein, 2003). Although citizens are nudged, or gently pushed, towards a behavior which ultimately promotes the common good, they are free to act differently; they could opt-out from the default choice. Perhaps one exception is when citizens do not realize that they had the option to opt out from a default (e.g., when one accepts the conditions of a long internet contract that includes several default options; it could be that the person does not even notice this, but just skips to the last page and clicks “agree”).

Feedback

Another way to nudge citizens towards greener choices involves giving them *feedback* in regards to the consequences of their actions (e.g., the amount of electricity they consume; how their consumption compares to relevant others; and so forth). Recall that the central theoretical idea behind nudging is that decisions are influenced by the context in which they are made (the assumption is that decisions are made here and now, *hic et nunc*). The type of feedback one receives influences the choice context and, therefore, it may also affect the individuals’ choices and behaviors. One example of the efficacy of this nudge is described in Fischer’s review (Fischer, 2008). Specifically, Fischer describes the manner in which

various types of feedback can promote a reduction in electric energy consumption.

Fisher sustains that feedback influences consumers' motivation to save electric energy because it indicates a problem (if consumers are not aware of their high electricity consumption, then why would they consider reducing it?) and what actions can help alleviate the problem (e.g., separate indicators for each electric appliance could help pinpoint the main sources of electric consumption). Fischer highlights several key factors for increasing the effectiveness of a feedback message. First, Fischer notes that a feedback is more effective when it immediately follows an action. Immediate feedback helps create a direct association between cause and effect, increasing consumers' awareness about the costs of their consumption choices. Second, frequent and repeated feedback for a prolonged period of time can facilitate the creation of habits (e.g., the habit of switching off the lights when one leaves the room), which may have positive consequences. Third, the effectiveness of feedback also depends on how precise and specific they are. For example, a detailed analysis of energy costs per room, time of day, and single electric appliance, may help consumers to adopt more efficient strategies to reduce their energy consumption.

An example of efficient feedback, which incorporates many of the key elements identified by Fischer, is provided by *Ambient Orb*, a light bulb produced by Southern California Edison that changes color depending on energy consumption (red when the consumption is very high, green when it is low/optimal). Thus, *Ambient Orb* provides an immediate, direct, and continuous feedback, in a context where consumers know what steps to take in order to save energy. Studies suggest that the adoption of this product has helped reduce energy consumption by 40% (see Thaler & Sunstein, 2008).

An example of a green nudge technique that combines descriptive social norms and feedback has been tested through the electricity bills sent to citizens by the municipality of the city of Sacramento (*The New York Times*, 31 January, 2009). Starting at

April 2008 around 35000 electricity users were extracted at random and received together with the traditional electricity bill a happy or sad face. The appearance of the happy or sad face depended on whether the user's consumption compared favorably or unfavorably to the mean consumption of 100 families from the *same* neighbourhood that had a similar household size and utilized the *same* type of heating system. Following six months from this intervention, Alexandra Crawford, the spokesperson of the municipality of Sacramento, declared that the results of the intervention were very encouraging and that the intervention had a bigger impact than more traditional methods such as price incentives/reduction when buying energy efficient electric appliances and so forth. This study shows that an economic incentive alone is not sufficient to promote an initiative: the incentive should also be *psychologically tempting*. Furthermore, the study shows that non-economic incentives (such as, a social-affective feedback) can be effective in changing people's behaviours.

The use of social comparison (or competition) and the associated emotions this process triggers were successively employed by other municipal administrations of metropolitan areas, such as those of Chicago and Seattle. Recently, the use of social competition to promote "green" behaviors was implemented in Massachusetts from a non-profit organization with the help of a local television network. Specifically, the non-profit organization planned a competition which involved announcing the more virtuous neighbourhood in terms of energy consumption. In this case, just as in the case of the intervention by the municipality of Sacramento, the results were encouraging and were obtained at a low cost.

Contextual priming

Another technique used to nudge citizens concerns *contextual priming*, which involves intervening on the environment (*atmospherics*) in which an individual has to make a choice. Nudging techniques based on contextual priming are congruent with the nudging philosophy, which holds that people construct their preferences online and that their preferences are influenced by characteristics of the

environment in which they have to make a choice. There are many contextual characteristics one can intervene upon including ones that have a social character (e.g., characteristics that concern the interaction between vendor and client) and ones that could be characterized as physical (e.g., one can alter the lighting, odors, sounds, architectural spaces, and so forth). Frequently, such context alterations involve modifying certain “peripheral information,” that is, information that is not directly related to the product that is being judged (e.g., they are unrelated to qualitative or quantitative aspects such as the price of the good).

Within the context of priming interventions, studies have examined whether the use of olfactory cues (such as pleasant ambient fragrances) can help promote green behaviours. For example, Bonini, Graffeo, Hadjichristidis and Perrotta (2015) examined when, and in what conditions, peripheral olfactory information may influence people’s willingness to pay for public goods. Specifically, the authors investigated two reforestation interventions—one concerning the National Park Adamello Brenta (which is mainly composed of pine trees) and another concerning the lemon cultivations near Lake Garda—in one of three ambient fragrance conditions: a Scots pine fragrance was diffused in the room, a lemon fragrance was diffused in the room, or no fragrance was diffused in the room. That is, each participant evaluated a single target public good in just one of the three fragrance conditions. The findings show a semantic congruence effect (but only for the least popular lemon garden public good): for this public good, WTP was higher when the lemon fragrance was dispersed in the room rather than when either no fragrance or the pine fragrance was dispersed in the room. In a subsequent study, the citizens who were given €8 to participate in the experiment, contributed €5.68 on average in favour of the lemon tree reforestation intervention when a lemon fragrance was dispersed in the air versus €4.80 when a Scots pine fragrance was dispersed in the air which, although it was evaluated as equally pleasant as the lemon fragrance, it was not semantically

congruent with lemon cultivations. The role of ambient fragrance on charity has also been documented by Liljenquist, Zhong and Galinsky (2010).

The finding that ambient fragrances can influence judgments and choices are hardly surprising for researchers studying multisensory marketing (see Turley & Milliman, 2000). *Sony*, for example, diffuses a fragrance of vanilla and mandarin orange in its 36 Sony Style Stores, which are boutiques showcasing Sony’s electronic goods (*Corriere della Sera*, October 3, 2006, p. 24). Notice, however, that the results reported by Bonini and colleagues are qualitatively different from many of those reported in multisensory marketing. In their study, people are unlikely to have confused or attributed an ambient fragrance to the characteristics of the target public good (this is different, for example, to promoting apples by dispersing a fragrance of fresh apples in the air). Moreover, the study by Bonini and colleagues shows that certain characteristics that are irrelevant for a particular choice (e.g., peripheral information such as ambient fragrance) are important theoretically. Sugden writes in relation to this (commenting on the effort of “saving” the rational decision theory): “This approach seems more credible for some anomalies than for others. For example, if stated valuations are affected by salient but clearly irrelevant cues, *it is difficult to claim that welfare is affected in a parallel way*” (Sugden, 2005, p. 10, emphasis ours).

Apart from olfactory contextual priming, studies have also investigated the impact of visual contextual priming. For example, Dorofeeva, Bonini and Hadjichristidis (2017) primed one group of participants with neutral images (e.g., geometric shapes) while another with images of nature (e.g., the image of a mountain). To hide the real purpose of the study, participants were instructed that their task was to rate how much they liked each image. However, the real measure of interest was the participants recycling behavior. Specifically, at the beginning of the experiment, participants were given a cookie (on a plastic plate) and a tissue paper. The main measure of interest was whether visual priming influences participants recycling behavior – i.e., whether it

affected whether participants properly disposed of the plastic plate (plastic bin) and the tissue paper (paper bin). The results demonstrate a significant effect of visual priming. The percentage of participants that recycled the plate and the paper were about twice as high in the nature priming condition (48% for the plastic plate; 45% for the paper tissue) than in the neutral priming condition (25% for the plastic plate; 25% for the tissue paper).

Future directions

Several of the reported studies involved laboratory experiments and examined judgments (e.g., stated willingness to contribute for a public good) rather than actual behavior (e.g., real monetary contributions). Therefore, it is unclear whether the results obtained extend to real-life situations. Thus, future research should test these interventions in the “wild,” such as through field experiments, and examine their real impact on pro-environmental behavior. Furthermore, for obvious theoretical reasons, most research has focused on a particular intervention. Future research could address whether combining interventions (default plus economic incentive; referent points plus social norms) could further aid the promotion of pro-environmental behavior. Even if the combined effect of interventions is not additive, such research could shed light into the underlying processes. Finally, some of the interventions are not readily “actionable” (Teachman et al., 2015). For example, the finding that priming participants with pictures of nature (in a computer screen) increases correct recycling practices is hard to put into practice. Therefore, future research should turn these ideas into interventions that could actually be implemented (e.g., pictures of nature near collection areas) and examine their efficacy.

General discussion

A plethora of behavioral findings suggests that the “constructed preference” theory provides a better account of how people evaluate public goods and make decisions about whether or not to support them (for a discussion see Lichtenstein & Slovic, 2006). Decisions about environmental public goods may be difficult for a number of reasons, which may force, in

turn, people to construct their preferences online. First, citizens are frequently unfamiliar about the target good they are asked to support. Consider, a donation request from a religious institution to improve the quality of life of a previously unknown ethnic group in the Amazon forest. Second, even if citizens are familiar with the target public good, they may have difficulties in translating their preferences into numbers. For instance, an individual may clearly prefer to save a panda than to save a wild goat but at the same time may not know how to translate this preference in a specific monetary contribution. Third, although citizens may be familiar with, or have a clear preference for, particular public goods when these are evaluated separately, they may find it hard to evaluate them when these are presented together. From the construction of preference perspective, it is also easy to make sense of results that contravene standard economic theory, such as that citizens are frequently insensitive to the size of the public good.

Therefore, the results discussed in this paper support the idea that people do not have stable preferences that are “revealed” in estimations about the value of a public good. Rather, people construct such preferences and WTP estimations in the here and now. Such evaluations are a function not only of the consequences deriving from supporting a public good (e.g., the associated costs and benefits) but also of how this evaluation is made: for example, how the consequences are mentally represented (e.g., how they are framed) and processed (e.g., whether people place more weight on affective reactions or analysis/reason). Of course, the two aspects may interact: an evaluation based on affective reactions may be favored by a given frame or a context of judgment such as when one is asked to evaluate a public good on its own, rather than jointly with another public good.

In conclusion, the research presented herein suggests that WTP evaluations do not reflect an economic preference but rather the responders’ attitude toward the good, as was suggested by Kahneman et al. (1999). The fact that the expression of the attitude is contingent on the features of the

context in which a choice takes place, opens several possibilities for the architect of choice to nudge people towards greener choices and lifestyles.

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绿色助推

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摘 要 我们人类当前的生活方式不是可持续的。提升可持续性的途径之一是发展更绿色的科学技术，另一种补充性途径是改变人们的态度、习惯和行为。在本文中，我们讨论了 6 种心理技术，其宗旨是推动或助推(nudge)人们做出更环保的选择和行为。这些心理技术涵盖范围非常广泛，有些可以远程使用，如在通知公告中建构沟通信息，有些则涉及对人们的决策情境做出的改变。因此，本综述关乎到各行业从业人员，如市场营销人员、政策制定者、消费者代表等。对于每项心理技术，我们讨论了其认知和(或)情绪的理论性基础。此外，我们探讨了目前文献中存在的空白，并提出了可填补这些空白的未来研究方向。

关键词 决策；助推；亲环境决策；情境效应

分类号 B849:C91

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